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THE LOCATION AND COST OF STRAWBERRY PRODUCTION

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FOREWORD

Changing production technology often leads to lower productions costs. As such changes occur in those areas where the new technology is applicable, there is a simultaneous change in production advantage or disadvantage of one area as compared to another. This has recently happened in the strawberry industry.

The dramatic changes occuring in the strawberry industry, especially in the freezing segment, have called attention to the need for information as to the significance of these changes for the future as well as the present.

Producers in an area which is unable to adopt a new technique may be subject to loss on existing assets. Those in an area of expanding production need information regarding the extent of their advantage and the probable extent of future expansion if they are intelligently to make their investment decisions.

With these considerations in mind, a regional research project was developed to study these matters in the frozen fruit and vegetable industry. The work is being conducted by the experiment stations of California, Oregon, Washington, and Hawaii and the Agricultural Marketing Service, United States Department of Agriculture. The farm production cost analysis of this report, however, required the cooperation of experiment station and extension service personnel in each of the states in which cost studies were made.

This report, the third in a series of Giannini Foundation of Agricultural Economics publications on the frozen deciduous fruit and vegetable industry, concerns the changing location of primary strawberry production centers and costs of production in several of the most important producing areas. A previous report dealt with the costs of processing strawberries for freezing, and a future report will combine these studies in a consideration of interregional competition in the frozen strawberry industry. Other products are to be similarly considered by the California Experiment Station and by other states cooperating in the regional project.

ACKNOWLEDGMENTS

Important contributions in gathering and checking the cost information reported herein were made by the following individuals, each of whom is a member of the experiment station or extension service staff of his state.

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THE LOCATION AND COST OF STRAWBERRY PRODUCTION

by

Carleton C. Dennis[1]

INTRODUCTION

The location of strawberry production in the United States has recently undergone exceptional change. In the years since World War II, there has been serious challenge to strawberry production areas that had previously achieved positions of leadership because of favorable climate or strategic location with respect to markets. This challenge has been fostered by the development of cost-reducing and product-changing production and processing techniques. Foremost among these is the increasing use of freezing in the strawberry industry.

While the use of freezing is not new to strawberries, the great growth of this industry has occurred only in recent years. This growth has required development of efficient preparation and freezing methods, expansion of cold storage warehouse space in both producing and consuming centers, adequate specialized transportation facilities, retail storage and display space, and home storage facilities.

In those areas where strawberries have shown greatest production increase in recent years, the development of improved farm production techniques has occurred simultaneously with these nonfarm technological improvements. New varieties with desirable characteristics have, for instance, been introduced in all of the major strawberry producing areas and improved disease control and production techniques have been developed.

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[1] Cooperative Agent of the Experiment Station, University of California, and the Agricultural Marketing Service, U. S. Department of Agriculture.

The technological changes within this industry and the resulting shifts in production location raise the question of production shifts which may occur in the future. Studies of interregional competition in the frozen strawberry industry are essential in consideration of this question.

One approach to such studies involves the definition of major markets and production areas or regions. The relative advantage of producing in any given region for shipment to a particular market then depends on market price, transportation and selling costs, and processing and production costs in each region. Regional production potentials and costs will, of course, differ because of variation among regions in the nature and quality of the local resources, prevailing level of prices for the employment of these resources, and other factors. Of particular importance is the nature of production alternatives in each area, since the "cost" of using particular resources in strawberry production includes consideration of the returns foregone by not using them to produce alternative crops. Each of the major factors affecting comparative advantage of strawberry production in the various regions is being investigated within the categories of production, processing, transportation, and selling. This report presents the changing production pattern and production costs in several important producing areas.

Production and Consumption Trends

In the decade of the 1920's, the average annual per-capita use of fresh strawberries was 4.2 pounds. Consumption dropped slightly to 3.5 pounds in the 1930's and to 2.1 pounds in the 1940's. In the 1950's, it has averaged only 1.5 pounds. The decrease of the 1940's can be attributed largely to production disruption of World War II, but the failure to regain lost markets since then indicates that there are other, continuing reasons for the loss of fresh strawberry markets.

Figure 1 shows the annual per-capita consumption of strawberries in the post-World War II years. Total per-capita consumption has had an increasing trend through these years, averaging 0.05 pounds per year. A consistently increasing trend is shown in annual per-capita frozen strawberry consumption. Per-capita consumption of fresh strawberries, however, was variable with a slight downward trend during this period.

Prior to 1946, frozen strawberry consumption represented a minor share of the total strawberry market. Since that time it has presented a strong contrast to fresh berry use. In 1946, the annual per-capita consumption of frozen strawberries in fresh weight equivalent was only about 0.3 pounds, but there has been an increase every year since then with the exception of 1950. The increasing consumption of frozen strawberries has more than offset the decreasing fresh strawberry use, with the net result of increasing total per-capita strawberry consumption. Despite the recent increases in per-capita strawberry use, however, total strawberry consumption in 1957 was only 3.0 pounds—less than three-fourths as much as the average of the years 1920-1929.

Total consumption is the product of per-capita consumption and total population. The rapid population increase has resulted in a greater increase in total consumption than the per-capita consumption trend indicates. Figure 2 shows strawberry production of the United States for the years 1946-1957. Total production is shown to increase consistently over this period, being 295,000,000 pounds and 115 per cent greater in 1957 than it was 11 years earlier. In this same period, production for the fresh market increased 50 per cent and production for processing increased almost 350 per cent.

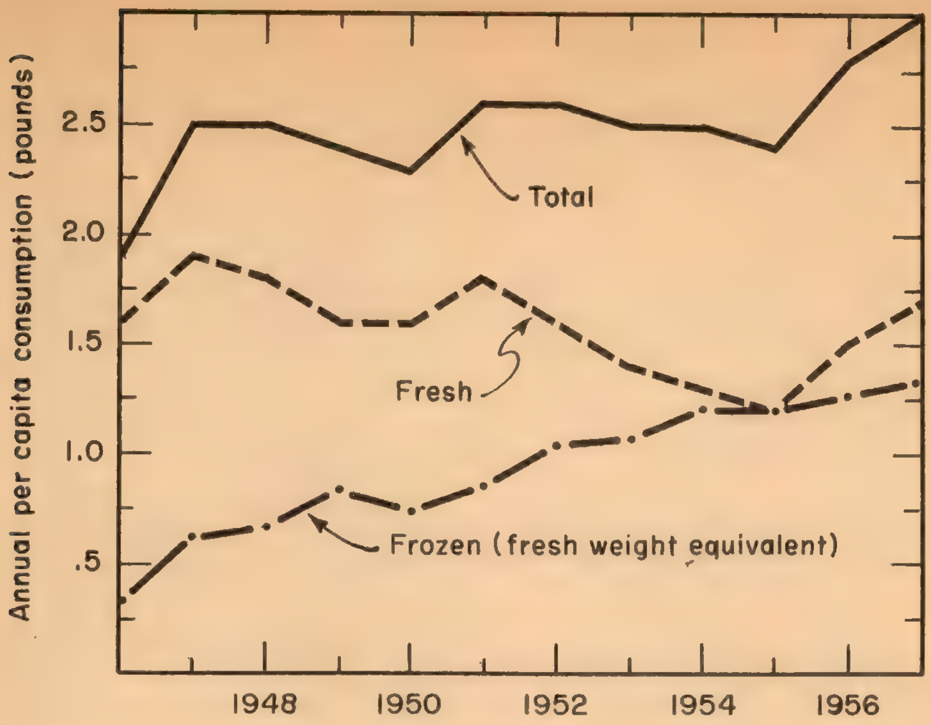


Figure 1. Per-captia consumption of strawberries in the United States; total, fresh, and frozen, 1946-1957.

Source of data: U.S.A.M.S. Supplement for 1956 to Consumption of Food in the United States, 1909-1952; Agricultural Handbook No. 62.

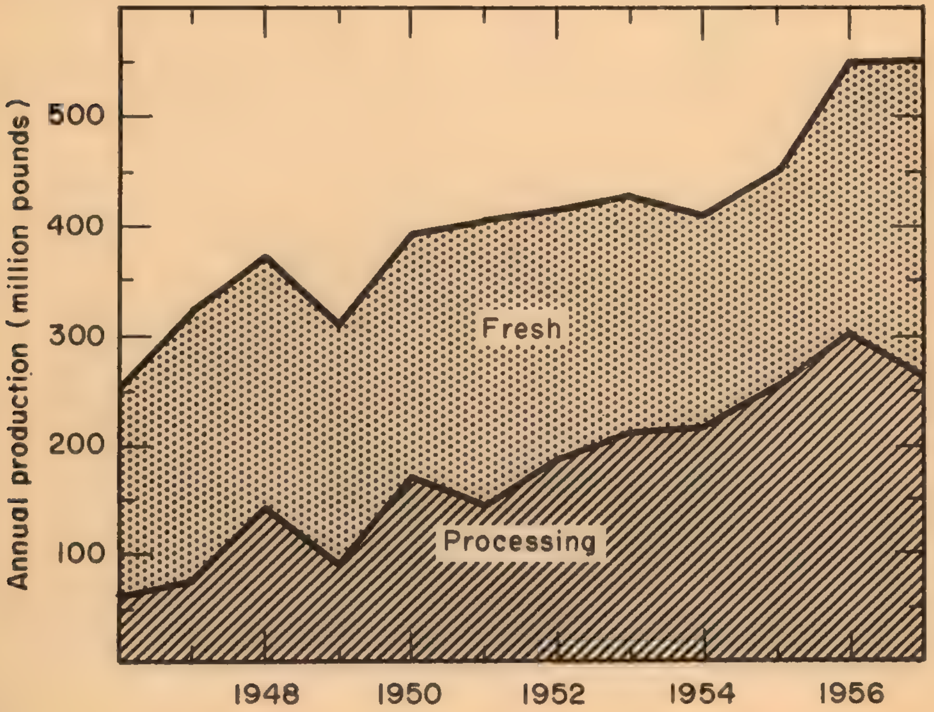


Figure 2. Annual strawberry production in the United States, 1946-1957.

Source of data: Reports of Agricultural Marketing Service, U.S.D.A.

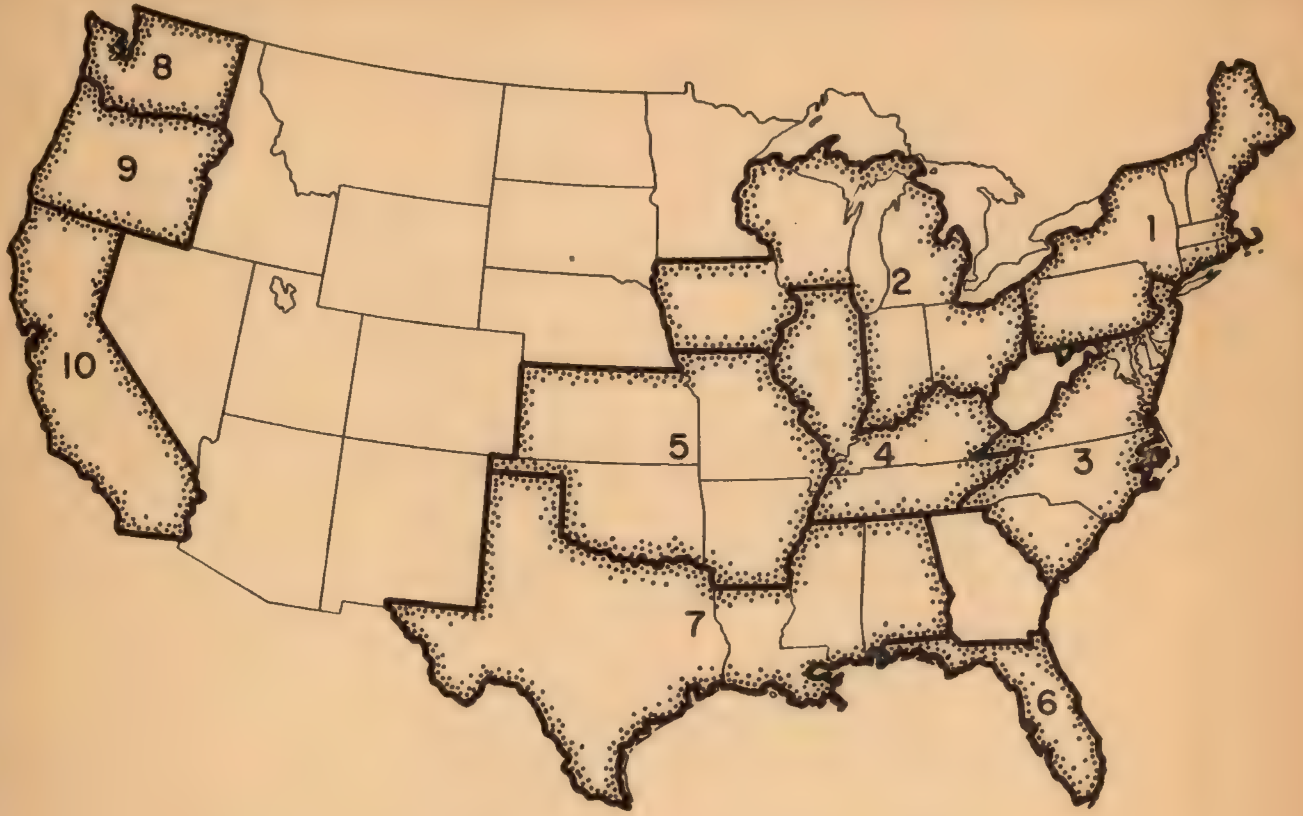
REGIONAL COMPARISONS

Regional Composition

In this study the United States was divided into ten production regions for purposes of comparison (see Figure 3). These regions were selected so as to define separate areas of relatively concentrated production and to include in each region contiguous areas of minor production. The size of the region thus defined does not indicate the volume of actual production nor is the location of major producing centers within regions specified. Major production centers are roughly indicated under Figure 3, however, by listing first in each region the state that contains the primary production center of that region.

Production

Not all regions of the country have shared equally in the recent production increases—some have even decreased. This is shown graphically in Figure 4 for the period since 1946. Regions 3, 4, 5, 6, and 7 have trends toward decreasing total strawberry production through this period although the trends in regions 4 and 6 are very small. Regions 1 and 2 have had small average annual increases in total production but significant increases have occurred only in regions 8, 9, and 10—the Pacific Coast states. Figure 4 also indicates the influence of processing on the growth of the strawberry industry. With the exception of region 1, increases in total annual output have occurred only in regions processing a fairly large quantity of strawberries. This is especially evident in regions 8 and 9 which produce almost exclusively for processing. Region 10, on the other hand, has rapidly increased production for both the fresh and processing markets.



Region	*States included*
1	New York, Pennsylvania, Connecticut, Massachusetts, Maine
2	Michigan, Ohio, Indiana, Wisconsin, Iowa
3	Virginia, North Carolina, South Carolina, Maryland, Delaware, New Jersey
4	Tennessee, Kentucky, Illinois
5	Arkansas, Missouri, Oklahoma, Kansas
6	Florida
7	Louisiana, Texas, Alabama
8	Washington
9	Oregon
10	California

FIGURE 3. Ten Geographical Regions Used in the Analysis of Strawberry Production,

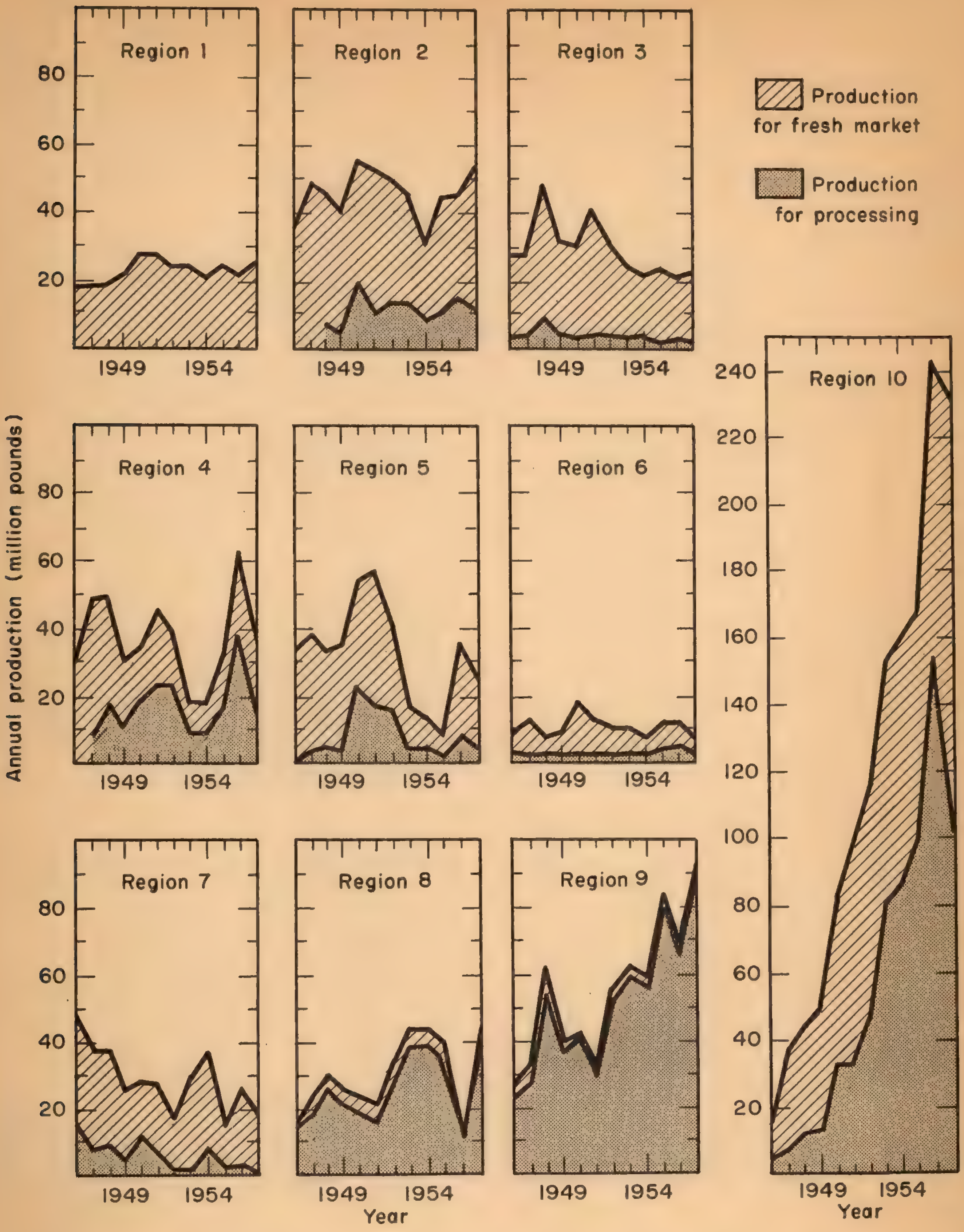


Figure 4. Annual strawberry production by producing region, 1946-1957.

Yield Per Acre

Total production change is due to the combination of changes in acreage and yield per acre—and acreage changes are often due at least in part to the cost-changing influence of yield changes of previous years. Figure 5 compares the yields per acre of the first and last halves of the post-war period, 1946-1957. In this figure the bar on the left for each region is the average of the yield per acre for the years 1946 through 1951 while the bar on the right is the average for the years 1952 through 1957. Only regions 8, 9, and 10—the same regions having recent large increases in total production and production for processing—have large increases in yield per acre. At the same time, regions 2, 4, and 5, the only other regions in which processing has been important to the strawberry industry of the region, have had decreasing average yields (although small) and have failed to show much increase in quantities processed. Although insufficient evidence is presently available to state a cause-effect relationship between yield and quantity processed, the obvious inference is that increased per acre yields of regions 8, 9, and 10 may have decreased unit costs in comparison with other regions and given them a competitive advantage in the processing market.

Harvesting Season

The harvesting season is important in two respects: date of harvest and length of harvest period. The date of harvest is of primary importance in production for the fresh market. Figure 6 gives the usual harvesting seasons for each region of the country. Region 6, for instance, is able to place fresh strawberries on the market in the winter months when competition from other areas is slight. Fresh strawberry prices at that time are sufficiently high to cover the high production costs of that region.[1] However, due to the high production

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[1] Production costs for at least one producing area of each region are given in Tables 4 and 5.

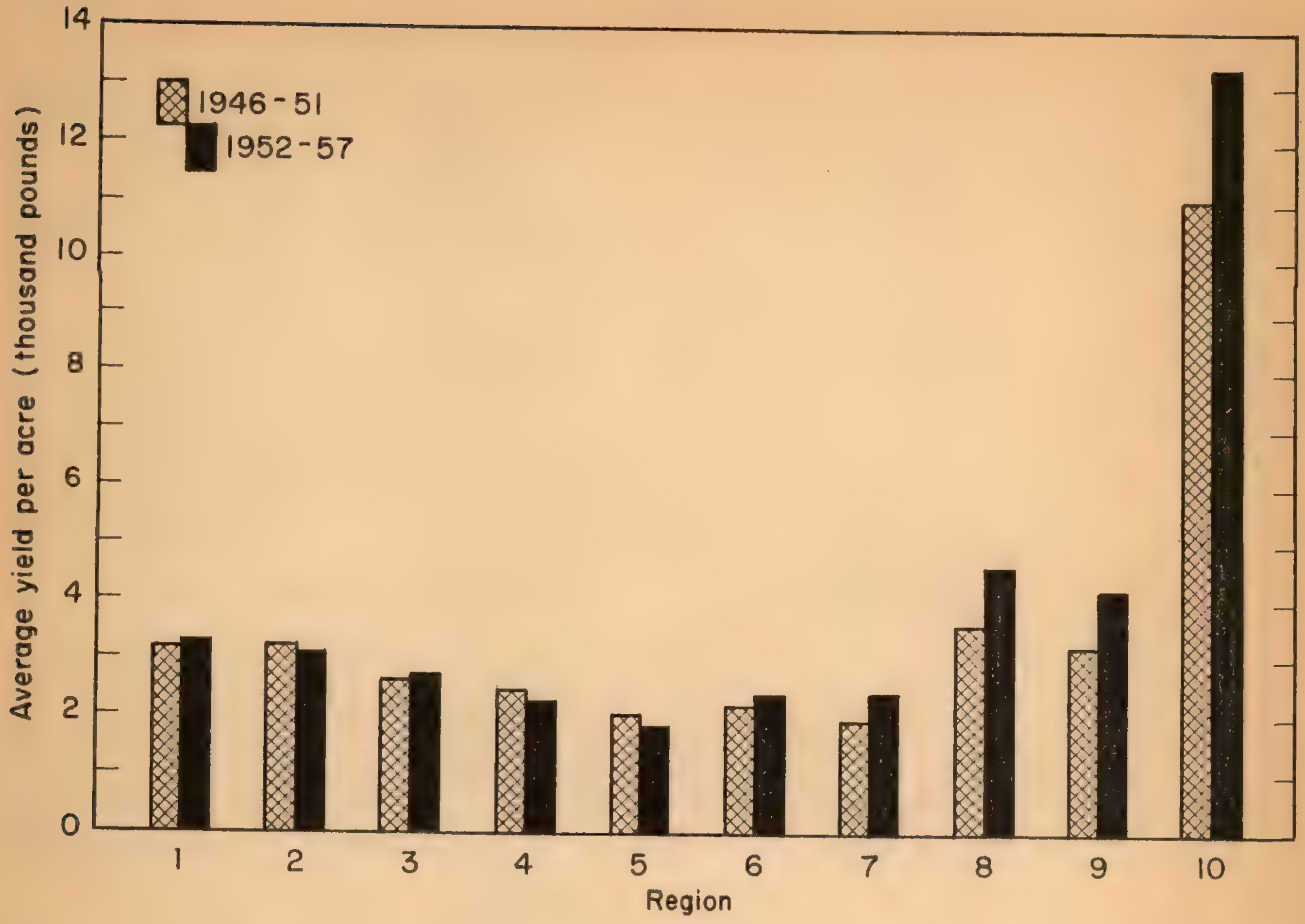

Figure 5. Comparisons of regional average strawberry yields in the years 1946-1951 and 1952-1957.

Source of data: Years 1946-1948, Marketing California Strawberries, 1955 Season, Table 20. Years 1949-1957, Marketing California Strawberries, 1957 Season, Table 24. These tables are compiled from reports of the Agricultural Estimates Division, Agricultural Marketing Service, U.S.D.A., Wash., D.C.

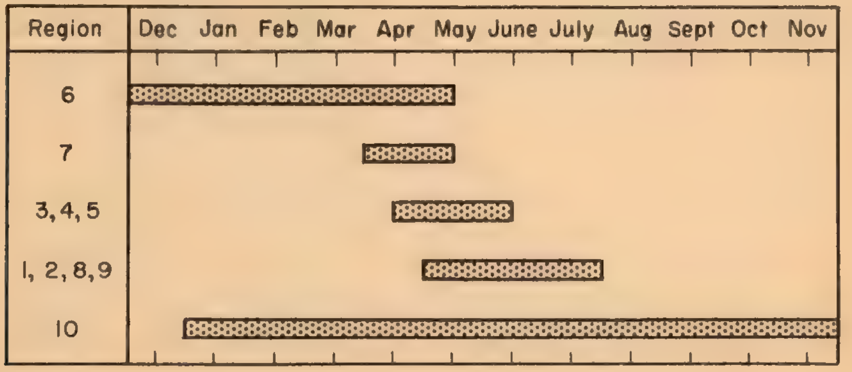

Figure 6. Usual strawberry harvesting seasons, by region.

costs, this region cannot successfully compete with other areas in production for the processing market; and only a minor amount, primarily cull berries and those harvested late in the season, enters this market. Other areas follow region 6 in harvesting season, and as the season progresses more berries become available for fresh consumption. As fresh market prices drop, production for the fresh market becomes less profitable, and a greater percentage of the berries enters the processing market. Thus, regions producing late in the season tend to produce primarily for processing. Region 10, having a long harvesting season, is able to compete successfully on the fresh market during several months of the year and can divert berries to processors during other months. This region has, therefore, become important in both markets.

The length of harvest period is important in several ways. A long season is usually though not necessarily, accompanied by greater yields per acre than is a short season; in this, California presents an outstanding example. A few days of bad weather can be disastrous if it occurs during the harvest period in areas of short harvest season, whereas this would result in only a partial loss of the crop if the harvest covered a longer period. If labor must be imported, a long season makes it easier to obtain that labor and helps to spread fixed labor procurement costs over a larger crop. Lastly, a long harvest season enables a processing plant to spread fixed expenses over a larger output and to adopt investment-increasing but cost-reducing techniques which would not be profitable if used for only a few weeks each year. Some of these benefits could be obtained through integrated use of labor force and processing plant for other products, spreading fixed costs over quantities of other products rather than over more strawberries.

PRODUCTION COST STUDY

Accurate production cost information is, to say the least, difficult to obtain. Several strawberry production cost studies have been made at various times but comparability of the results is doubtful. Furthermore, recent changes in production technique render many of these studies obsolete. It was, therefore, considered necessary to develop current and comparable farm production cost estimates.

Cost Estimating Method

An ideal study would enable calculation of the quantities of strawberries that would be produced in each region over a range of prices. This would require determination of production costs and returns not only for strawberries but for all competing products because only the most profitable products will be produced even though others might also show some profit. It would be necessary, too, to determine costs and returns for each producer since costs and returns differ among producers within a region. This task is well beyond the possibility of attainment in this study.

Useful approximations to production costs on a much simpler basis were, however, obtained in this study through a group interview technique which requires a comparatively small input of time. This consisted of gathering a small group of producers together and going over the production process to obtain estimates of requirements in hours of labor and equipment use and quantities of materials used in strawberry production. As the group interview progressed, a consensus or group opinion of the procedures usually followed in strawberry production and inputs required for each process was obtained. The interviewer acted only to guide the discussion and record conclusions.

The objective of this interview was to obtain information which would enable calculation of the production costs of a "representative" producer of the area. The "representative" producers are defined as the type of producers—as described by strawberry acreage, production practices, and yields—who collectively have the greatest influence on the market. If a relatively few very large producers supply the largest quantity of berries, costs were obtained for their operation. If most of the marketed strawberries are produced on small acreages, costs were obtained for them.1/

Location of Studies

Although 95 per cent of the frozen strawberry production is concentrated in five states and over 85 per cent is in three states, it was considered necessary to determine production costs in all sections of the country to determine their potential as competitors in this market. Accordingly, group interviews were conducted in the states of Washington, California, Arkansas, Louisiana, Florida, Virginia, New York, and Michigan. Actual costs of a group of Oregon producers were utilized to determine costs for that state, and recently obtained individual interview data were utilized in Tennessee.

Production Costs

The production cost study of each area was analyzed in detail to determine each component of production cost as well as the total cost estimate. It was found that commercial strawberry production methods and costs vary between regions in many ways. Some of the most important of these variations are the cost of establishing a planting and the number of harvest years over which that cost

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1/ Some weaknesses in this procedure are recognized. A single-cost point is obtained, based on the estimates of a rather small group of producers. However, the estimates of well-informed producers when carefully obtained, that is, when the producers are instructed as to the estimate desired and in the process of obtaining it, are felt to be good approximations to the production costs of most of the marketed strawberries of the area.

can be spread; the acreage per producer; investment in land, equipment, and buildings; and amount and cost of direct labor. The yield obtained is, of course, an important determinant of unit costs because an apparently high total cost could become a low unit cost if yield is sufficiently high.

The estimates on which production costs for "representative" producers are based are given in the following pages for each of the areas studied. Cost calculations based on these and estimates of labor and materials inputs are given on pages 19 to 23.

Life of the Planting

In few, if any, areas can it be categorically stated that a commercial strawberry planting will bear only a certain number of years. The usual life of a planting in a given region (Table 1) was, therefore, used in the cost calculations. Only rarely does a planting bear more than one year in either Louisiana or Florida. The usual practice in New York is also to obtain only one producing year, although many plantings bear two or more years. In the southern states, berries are planted and harvested within a 12-month period; but in New York the plants do not bear the first year so a single harvest requires use of the land for two years. The producers of many areas feel that the yield decreases too much after the second bearing year to warrant renovation and that the greater yield obtained from a new planting will more than offset the cost of that planting. The producers of Arkansas, Tennessee, Oregon, Washington, and the Monterey-Santa Cruz area of California, however, consider three bearing years to be a reasonable life of a strawberry planting.

Acreage

The strawberry acreage of individual producers within a given area may vary considerably, but most of the production will typically occur on plantings which fall within a comparatively small acreage range. The producers of each area were

TABLE 1

Acreage, Planting Life, and Expected Yield on Typical Commercial Strawberry Operations

Region	State	County	Typical acreage for harvest	Usual bed life	Expected annual yield
				harvest years	average pounds per harvested acre
1	New York	Erie and Chautauqua	10	1	5,667
2	Michigan	Berrien	5	2	6,233
2	Michigan	Manistee	10	2	8,000
3	Virginia	Accomac and Northampton	20	2	4,533
4	Tennessee	Cumberland	6	3	3,740
4	Tennessee	Macon	6	3	4,080
4	Tennessee	Madison	6	3	3,400
5	Arkansas	White	4	3	2,153
6	Florida	Hillsborough	2	1	5,357
7	Louisiana	Tangiapahoa	4	1	3,400
8	Washington	Whatcom	12	3	9,000
9	Oregon	Yamhill	7	3	10,057
10	California	Monterey and Santa Cruz	20	3	22,800
10	California	Stanislaus	15	2	10,000

asked to estimate the acreage of the representative producer of their area. These estimates, given in Table 1, are necessary to enable spreading of certain fixed costs—primarily equipment—over the acreage handled. In addition, a general description of the entire farming operation of this representative producer was obtained in order that an allocation of fixed costs of equipment used for strawberries and other products might be made.

Yield

Perhaps the most crucial estimate made in arriving at the cost estimation is the expected yield. It is notable that in every case the estimated yield (Table 1) is higher than the area average for the six-year period, 1952-1957 (Figure 5). Some of the estimates, of course, differ much more from the six-year average than do others. The estimates of even Tennessee and Oregon, which are based on yields of a sample of producers, are higher than the averages of the areas in which these states are contained. Since yield estimates obtained in the group interviews are based on the practices for which costs were estimated and since they are intended to represent the yield to be expected by typical commercial producers rather than the average of all producers of the area, the estimates are considered acceptable.

Investment Per Bearing Acre

One of the determinants of production cost, although of less importance than might be expected, is the investment required per acre of bearing strawberries. This is given in Table 2 for land, equipment, and buildings. The investment in the strawberry planting is given as part of the costs in a following section. Land investment per bearing acre is not necessarily synonymous with land value per acre. It is determined by dividing the total investment in land devoted to strawberries by the number of bearing acres. Thus, in an area where berries do not bear during their first year and have two bearing years, the nonbearing year is

TABLE 2

Investment in Land, Equipment, and Buildings Per Acre of Bearing Strawberries

Region	State	County	Average level of investment per bearing acre			
			Land	Equipment	Buildings	Total
			dollars			
1	New York	Erie and Chautauqua	800	171	12	983
2	Michigan	Berrien	675	123	10	808
2	Michigan	Manistee	200	461	100	761
3	Virginia	Accomac and Northampton	450	44	4	498
4	Tennessee	Cumberland	150	25	11	186
4	Tennessee	Macon	203	49	11	263
4	Tennessee	Madison	223	69	11	303
5	Arkansas	White	100	129	17	246
6	Florida	Hillsborough	750	250	88	1,088
7	Louisiana	Tangiapahoa	300	183	25	508
8	Washington	Whatcom	400	457	44	901
9	Oregon	Yamhill	466	400	50	916
10	California	Monterey and Santa Cruz	a/	965	b/	965
10	California	Stanislaus	a/	980	b/	980

a/ Costs calculated on land rental basis. Annual rental in Monterey and Santa Cruz counties--$100, in Stanislaus County--$75.

b/ Buildings usually not provided.

divided between the two bearing years and the land investment per acre is one and one-half times the estimated land value. Land investment is not given in Table 2 for California producers because the representative producer is considered to rent rather than own the land. In this case the rental charge is included in the cost calculation. The average level of investment in equipment and buildings over time is equal to one-half of their replacement cost since, in the long run, an average of one-half of their use life will have been expended. The replacement cost was determined by first estimating the total replacement cost of all equipment and buildings used in strawberry production. Some of that equipment and buildings is used for other products in nearly all cases, so the next step was to allocate a portion of the total replacement cost to the strawberry enterprise based on the proportion of total use that was expected to be expended on strawberries. The remainder was then divided by the number of acres of bearing strawberries on the typical operation to obtain the estimated investment per bearing acre.

Direct Labor

While mechanization has been generally employed in applicable operations, strawberries require a large amount of hand labor. Hoeing and weeding, for instance, still require a considerable quantity of hand labor, although specialized weeding equipment is being developed. Harvesting, which is a major cost in strawberry production, is not adaptable to mechanization.

The cost of direct labor per pound of strawberries is given in Table 3 on the bases of both excluded and included harvest costs. These figures emphasize the great diversity in production methods employed in different areas. Direct labor, for example, represents from 16 to 66 per cent of the nonharvesting cost. Most of this difference is due to the difference in physical factors—climate, topography, soil type, etc.—requiring different cultural techniques. Also, as a

TABLE 3

Wage Rates and Direct Labor Costs of Strawberry Production, by Location

				Direct labor cost			
				Excluding harvest		Including harvest	
Region	State	County	Wage rate, cents per hour	Cents per pound	Per cent of non-harvest cost	Cents per pound	Per cent of total cost
1	New York	Erie and Chautauqua	70	1.6	24	8.0	58
2	Michigan	Berrien	60	1.9	40	8.6	62
2	Michigan	Manistee	75-100	0.7	16	7.5	65
3	Virginia	Accomac and Northampton	65	0.5	16	9.7	77
4	Tennessee	Cumberland	50	2.9	69	9.8	84
4	Tennessee	Macon	50-65	2.3	58	9.5	82
4	Tennessee	Madison	45-65	1.2	40	9.9	80
5	Arkansas	White	50-75	3.4	51	12.8	77
6	Florida	Hillsborough	50-65	2.9	29	17.6	70
7	Louisiana	Tangiapahoa	70	7.9	63	17.4	76
8	Washington	Whatcom	100	1.4	28	6.1	64
9	Oregon	Yamhill	100-150	0.8	25	7.4	76
10	California	Monterey and Santa Cruz	110-135	2.0	38	6.4	67
10	California	Stanislaus	100-125	2.1	31	8.1	60

general rule, the direct labor input per acre varies inversely with the acreage handled, due in large measure to the increased degree of mechanization as strawberry acreage per farm increases.

In those cases where a large part of the labor is furnished by the operator and his family, the direct labor charge represents the major area of cost flexibility in that a smaller wage may be accepted, at least in the short run, to enable continued production. In those cases where most of the labor is hired, this cost flexibility is not available. Most of the direct labor, however, is involved in harvesting which in most areas occurs over a few weeks, at most, and an operator and his family can furnish this labor for only very small operations.

Total Production Costs

The total cost of producing strawberries is composed of two major parts: harvesting and nonharvesting. Nonharvesting expense can be further divided into the cost of bringing a new planting to its first harvest and the cost involved in caring for the planting from one harvest to the next. The direct cost of labor and materials used in each of these categories, the overhead cost, and harvesting cost are given in Table 4 for each of the areas studied. The total cost per bearing acre is the sum of these costs.

Each of the components of nonharvesting costs is given in Table 4. Total nonharvesting cost per bearing acre as given in this table is the sum of all except harvesting costs. "Overhead per bearing acre" is a fixed annual cost regardless of number of harvest years. "Establishment to first harvest" is the variable cost incurred to bring the strawberry planting to the first harvest and "annual between-harvest expense" is the cost incurred in caring for the planting from one harvest to the next. If only one harvest is obtained from a planting, the total nonharvesting cost is the sum of "overhead per bearing acre" and "establishment to first harvest" costs. If second or third harvests are obtained from a planting, the cost of care of the planting from one harvest to the next

TABLE 4

Strawberry Production Costs Per Acre for Labor, Materials, Overhead, and Harvesting in Several Major Producing Areas

Region	State	County	Establishment to first harvest			Annual between-harvest expense[b]			Annual overhead per bearing acre			Total nonharvesting cost per bearing acre[c]	Harvest cost per bearing acre	Total cost per bearing acre
			Labor	Materials	Miscellaneous[a]	Labor	Materials	Miscellaneous[a]	Interest on investment	Depreciation, repair, and upkeep of buildings and machinery	Miscellaneous (taxes, licenses, office etc.)			
			dollars											
1	New York	Erie and Chautauqua	92	183	--				56	38	13	382	400	782
2	Michigan	Berrien	149	153	10	44	15	9	35	21	13	259	570	829
2	Michigan	Manistee	72	182	7	37	57	9	45	108	10	345	575	920
3	Virginia	Accomac and Northampton	39	104	--	6	43	--	28	11	2	137	434	571
4	Tennessee	Cumberland	144	56	--	92	14	--	10	7	3	157	279	436
4	Tennessee	Macon	159	91	--	60	13	--	14	10	3	159	315	474
4	Tennessee	Madison	115	65	--	5	15	--	16	12	3	104	314	418
5	Arkansas	White	184	99	--	13	21	--	13	9	4	143	216	359
6	Florida	Hillsborough	156	184	62				54	74	5	535	810	1,345
7	Louisiana	Tangiapahoa	269	67	--				25	48	19	428	356	784
8	Washington	Whatcom	206	230	38	81	71	--	58	96	36	431	424	855
9	Oregon	Yamhill	d/									313	665	978
10	California	Monterey and Santa Cruz[e]	712	457	150	309	104	106	48	157	172	1,163	1,026	2,189
10	California	Stanislaus	378	230	247	209	48	89	22	22	25	669	673	1,342

[a] Composed primarily of charges for custom work including both labor and materials, includes land rental in California. Dashes indicate that no miscellaneous expenses are included in the cost estimates of those areas.

[b] "Between harvest expense" appears only for those areas typically having two or more harvest years from a given planting.

[c] Includes "overhead per bearing acre" and weighted average of "establishment to first harvest" and "between harvest expense." For instance, if two harvest years are obtained, it includes "overhead per bearing acre" plus one-half of the "establishment to first harvest" cost and one-half of the "between harvest expense." If three harvest years are obtained, it includes "overhead per bearing acre" plus one-third of the "establishment to first harvest" cost and two-thirds of the "between harvest expense."

[d] Cost component composition of the Oregon study differs from those of other studies so only total cost is given.

[e] Additional studies are now being conducted in this region.

enters the cost calculations. If the planting bears two years, the second year overhead cost remains the same as for the first bearing year; but the total cost for the first bearing year differs from the second year, that is, the second bearing year would cost the sum of "overhead per bearing acre" and "annual between harvest expense." The average costs per bearing acre would be the average of the costs of the first and second years. This could be found directly by taking the sum of the "overhead per bearing acre," one-half of "establishment to first harvest" because this cost applies to one-half of the bearing years, and one-half of the "annual between harvest expense" because this cost also applies to one-half of the bearing years.

Harvesting costs presented in Tables 4 and 5 are for processing berries (caps removed) and would need adjustment before being applied to fresh market berries. This adjustment would consist primarily of a picking differential—because the caps are not removed from fresh market berries—and an adjustment in the container charge. The harvest cost includes picking (including housing and transportation of pickers), supervision, hauling the product to market, and a container charge where applicable. Harvest costs are shown to be equal to or greater than nonharvest costs in all except two of the areas studied.

Unit Production Cost

Production cost per pound, based on the costs given in Table 4 and yields of Table 1, are shown in Table 5. The production costs of only Florida and Louisiana seem to be so high as to be considered noncompetitive in the frozen strawberry market on the basis of production costs alone. These areas are presently strong only in the fresh market and are able to enter that market because of their early production season. Even that advantage is somewhat weakened by the availability of frozen strawberries—a substitute for fresh strawberries—during their harvest season.

TABLE 5

Regional Harvest, Nonharvest, and Total Strawberry Production Costs Per Pound

Region	State	County	Cost per pound		
			Harvest	Nonharvest	Total
			cents		
1	New York	Erie and Chautauqua	7.1	6.7	13.8
2	Michigan	Berrien	9.2	4.7	13.9
2	Michigan	Manistee	7.2	4.3	11.5
3	Virginia	Accomac and Northampton	9.6	3.0	12.6
4	Tennessee	Cumberland	7.5	4.2	11.7
4	Tennessee	Macon	7.7	3.9	11.6
4	Tennessee	Madison	9.2	3.1	12.3
5	Arkansas	White	10.0	6.7	16.7
6	Florida	Hillsborough	15.1	10.0	25.1
7	Louisiana	Tangiapahoa	10.5	12.6	23.1
8	Washington	Whatcom	4.8	4.7	9.5
9	Oregon	Yamhill	6.6	3.1	9.7
10	California	Monterey and Santa Cruz	4.5	5.1	9.6
10	California	Stanislaus	6.7	6.7	13.4

Washington, Oregon, and the Monterey-Santa Cruz area of California have a definite cost advantage, all three having total costs of 9.7 cents or less per pound, while the next lowest cost (of Manistee, Michigan) is 11.5 cents. The next 8 of the 14 areas studied fall within a 2.5 cents-per-pound range in production cost, but the remaining 3 areas are considerably higher.

The question of the comparative advantage of different areas cannot, of course, be answered in terms of only production costs. Lower transportation costs, for example, may enable some areas near major markets to survive as frozen strawberry producers despite relatively high unit production costs. Differences in processing and distribution costs may similarly affect the relative advantage of production and processing in different areas. A complete analysis is not attempted here.[1]

SUMMARY

The quantities of strawberries produced in various localities in the United States has undergone considerable change in recent years. Most notable in this change is the great increase in production in Washington, Oregon, and California. While some decrease in total output has occurred in certain areas, most of the increase in total output in the western states has been absorbed by increased total consumption. Although per-capita fresh strawberry consumption has decreased, total per-capita consumption has increased steadily due to a rapidly increasing per-capita frozen berry consumption.

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[1] A future report in this series will consider processing and transportation costs as well as production costs and the combined effect of the three cost components.

The rapidly changing pattern of strawberry production makes important the question of production shifts which may occur in the future. This requires analysis of interregional competition in the frozen strawberry industry. To make this study, all of the components of cost from farm production to sale to the consumer must be considered. Production for a given market will tend to occur in those areas for which the combined costs of production, processing, shipping, and selling in that market are lowest.

Each of the major factors affecting comparative advantage of strawberry production in the various regions is being investigated within the categories of production, processing, transportation, and selling. This report presents the changing production pattern and current production costs in several important producing areas.

Estimates of requirements in hours of labor and equipment use and quantities of materials used were obtained through a group interview technique as a basis for production cost estimation. Important cost determinants were found to be the life of the strawberry planting, acreage handled per operator, investment per bearing acre, amount of labor required, and yield obtained.

Considerable variation was found among regions in most of the cost determinants. For example, the harvest years obtained from a strawberry planting varied among regions from one to three years. Two to 20 acres of strawberries were estimated to be produced by the representative producers of various regions.[1] Investment per bearing acre, in addition to the cost of the strawberry planting, varied from $186 in Tennessee to $1,088 in Florida; and expected average yield per bearing acre ranged from 2,150 pounds in Arkansas to 22,800 pounds in California.

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[1] Individual plantings, of course, often yield more than three years and are often more than 100 acres in size.

These variations are reflected in the range among regions in average total cost per pound which are estimated to vary from a low of 9.5 cents in Washington to a high of 25.1 cents in Florida. Most of the cost estimates fell within a rather narrow range with costs in three regions being grouped in a low bracket of 9.5 to 9.7 cents and eight from 11.5 to 13.9 cents.

With the exception of the two or three highest cost regions, the farm production cost differential is not sufficient to allow a decision concerning comparative advantage. It is possible that areas with moderately high production costs may have sufficient advantage with respect to processing or transportation cost or both to enable competition in some markets with those areas having lower production costs. Related costs such as these are the subject of a study now being conducted and will be included in a future report on interregional competition in the frozen strawberry industry.

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